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ON STAUROLITE CRYSTALS AND GREEN MOUNTAIN GNEISSES OF THE SILURIAN AGE.*

BY PROF. J. D. DANA.

IN a paper published in the "American Journal of Science" in 1872 I mentioned the fact, first noticed by Percival, that crystals of staurolite are found in Salisbury, Connecticut, in mica schist "underlying" directly the Stockbridge or Canaan limestone. Since then I have found in southern Canaan, at a locality in Falls Village, west of the Housatonic River (to which I was directed by Dr. Stephen Reed of Pittsfield), crystals of this mineral in a very similar, well-characterized mica schist; but in this case, the schist *overlies* the limestone and is, therefore, the newer rock.† This staurolitic mica schist contains also small garnets. The order of superposition is free from all doubt, for the Canaan limestone outcrops at the bottom of the same hill, from beneath the schist, and the dip is not over fifteen degrees.

The age of the Stockbridge limestone is admitted by all recent writers on the subject to be Lower Silurian. Logan referred it to the Quebec group or the formation next below the Chazy. But since then Billings has described fossils from the same limestone at West Rutland, which he has identified as Chazy. And the Crinoids and other species, mentioned in the "Vermont Geological Report" as found in the limestone at other Vermont localities appear to show, as long since suggested by Professor James Hall, that the Trenton limestone is also present in the formations. The Chazy and Trenton limestones (Black River included) follow one another in New York, and the west and south. That the Canaan limestone is the same identical stratum that occurs at Stockbridge in Massachusetts, and farther north at Pittsfield, I know from a personal tracing of the rock throughout this region; and examinations still farther north in Massachusetts and Connecticut lead me to believe in the conclusion of the geologists of the Vermont survey, that all is one formation—the Stockbridge limestone, or the Eolian as Hitchcock named it.

* Read at the Portland Meeting of the Amer. Assoc. Adv. Sci.

† From facts I have observed elsewhere, I think it probable the Salisbury schist is also an *overlying* rock.

The fossils found in Vermont lead to the conclusion that the limestone represents the Trenton era as well as the Chazy. The overlying mica schist and other associated rocks have a thickness of at least three thousand feet; and, if the limestone is Trenton in part, they belong to an era later: either to a closing part of the Trenton period, or to the period of the Hudson River or Cincinnati group.

In any case there is no reason to doubt that the staurolites occur in rocks of the later part of the Lower Silurian age, and strong reason for the conclusion that these schists are in age veritable Hudson River rocks.

On this view, the Hudson River or Cincinnati group, in the Green Mountains — alike in Connecticut, Massachusetts and Vermont, — includes beds of quartzite, mica schist, chloritic mica slate, hydro-mica slate (the talcose slate of the earlier geologists), well-characterized gneiss of various kinds, some of it much contorted, and granitoid gneiss.

At a locality at South Canaan village, in Cobble Hill, the lowest rock over the limestone is quartzite; next follows mica schist passing into gneiss; and above this there is a light-colored granitoid gneiss, breaking into huge blocks with very little of a schistose structure.

Near the boundary of the towns of Tyringham and Great Barrington, four miles east of the latter village, a locality long since studied by Mr. R. P. Stevens of New York, and by him pointed out to me, there are, over the limestone, alternating beds of quartzite gneiss and limestone dipping at a small angle to the eastward. Commencing below, the succession is

1. Granular limestone, that of the valley.
2. Mica schist, a thin bed.
3. Hard jointed quartzite, 30 feet.
4. White granular limestone, 60 feet.
5. Hard jointed quartzite, 20 feet.
6. Gneissoid mica schist, 30 feet.
7. Bluish granular limestone, 40 feet.
8. Mica schist, 6 to 8 feet.
9. Quartzite, partly laminated, 120 feet, forming a high bluff, — the site of Devany's hearthstone quarry; and then
10. Gneiss, forming the top of the bluff, and having great thickness in a ridge to the northeast, but in its upper portions becoming very silicious or in part quartzite.

The fact that quartzite, limestone and gneiss or mica schist here alternate with one another is beyond question; and, if I am right in the age of the deposits above suggested, the alter-

nations occur at the junction of the Trenton and Hudson River formations.

The above section occurs on the east side of a small open valley. On the west side of the same valley the foot of the bare front of the hill consists of quartzite, dipping slightly to the north-westward, as if one side of a very gentle anticlinal of which the rock of the Devany quarry is the opposite. The quartzite, although hard and generally pure, contains a layer of mica schist ten inches thick which becomes pure quartzite a hundred feet to the eastward. Above the quartzite follows gneiss, which continues westward three miles, in a shallow synclinal, to Great Barrington, and there this gneiss is overlaid by a second thick stratum (100 feet or so) of quartzite. Here, then, there are two strata of quartzite separated by two or three hundred feet of gneiss, the whole overlying the Stockbridge limestone. The gneiss is a very firm rock, covering the slopes in some places with blocks like houses in size, where upturned through the growth of trees. I had suspected that it was one of the older gneisses of New England, until I found that it was overlaid by quartzite, and, on tracing further the stratification, proved that it belongs unquestionably to the series of rocks newer than the limestone.

From the facts which have been presented it follows that all old-looking Green Mountain gneisses are not præ-silurian, and, further, that the presence of staurolite is no evidence of a præ-silurian age.

NOTE ON BUFO AMERICANUS.*

BY REV. DR. THOMAS HILL.

THIS note is intended as a contribution toward the psychology of the American toad; simply presenting some evidences of intelligence and of capacity for learning to which I have been witness.

In the summers of 1843-5, an old toad used to sit under the door of a beehive every fine evening, and dextrously pick up those bees which, overladen or tired, missed the doorstep and fell to the

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